

## THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

## PRESSURE.

The distribution of mean atmospheric pressure for January, 1907, over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

Over northern Minnesota, North Dakota, and eastern Montana, and extending northward into the districts of Canada from Hudson Bay to British Columbia, the great continental winter area of high pressure was much intensified during the month, and barometric readings were almost continuously above the normal. From the southern edge of this region of high pressure were projected numerous highs, which, following each other in rapid succession, gave severe wintry conditions along the entire northern boundary from the Great Lakes westward to the Pacific.

Unusually high pressure over the Ohio Valley and middle Atlantic coast districts acted somewhat as a barrier to the south-eastward progress of the high areas, with corresponding cold, discharged over the northwestern States, and their energies were largely dissipated in the region west of the Great Lakes.

Over the central Rocky Mountain district, where high pressure is the rule during January, and the clear, dry atmosphere intensifies radiation, thereby reinforcing the cold waves moving southeastward along the eastern slopes of the Rockies, there was a marked absence of normal conditions.

Low pressure was the rule in the above-mentioned district, and it was the central point in the formation of numerous low areas whose eastward movements were along the southern edge of the high areas from the north as far eastward as the Great Lakes, and thence along the northern edge of the high pressure area over the Ohio Valley and the Middle Atlantic States. As a result of the unusual distribution of pressure, the surface winds departed materially from their normal courses, and districts in close proximity showed continuously marked variations in weather conditions, depending upon whether they were under the influence of cold northerly or warm southerly winds.

Over northern New England, the upper Lakes, and the upper Mississippi and Missouri valleys, cold northerly winds prevailed; over the Atlantic and Gulf districts, the lower Mississippi Valley, and westward to the Pacific, warm southerly winds predominated.

Pressure was above the normal in all districts of Canada and over all portions of the United States east of the Rocky Mountains. The departures were unusually large over British Columbia and the adjoining territories on the east, where the monthly averages exceeded the normal from .15 to .25 inch. Over all districts in the United States west of the main ranges of the Rockies pressure averaged lower than the normal.

## TEMPERATURE.

January, 1907, was a month of marked extremes in the monthly temperature. Over the entire southern portion of the United States abnormally warm weather prevailed, especially during the first twenty days, while along the northern border from the Lakes westward to the Pacific and over northern New England the month was one of continued cold.

Over northern Minnesota, North Dakota, the northern portions of Montana, Idaho, and Washington, and extending into the adjoining Canadian districts, the negative departures from the normal were phenomenal, ranging from 10° to more than 20° daily below the average. At numerous points in Montana and adjoining districts the month was the coldest on record, altho the minimum extremes were not as great as in some previous years. In northern Minnesota, North Dakota, and northeastern Montana, the maximum temperatures did not rise above the freezing point during the entire month, and with the exception of one or two days the minimum temperatures

were continuously below zero. While severe winter weather was the rule along the northern border, warm, springlike conditions existed in the Gulf States, where monthly means as high as, and in some cases higher than, ever before recorded were the rule.

A severe cold wave overspread New England on the 16th and 17th, with minimum temperatures in the more northern portions from 20° to more than 40° below zero, values in some instances lower than previously recorded in more than forty years. A rather severe cold wave overspread the central valleys, Lake region, and eastern districts from the 20th to the 24th, with freezing temperatures in the interior of the east Gulf States, and minimum temperatures 25° or more below zero in central New England.

No severe cold waves occurred over the Great Plains from Nebraska to Texas, the lower Mississippi Valley, nor over the central and southern districts of the Plateau and Pacific coast regions.

## PRECIPITATION.

In the Ohio and middle Mississippi valleys the precipitation, as in November and December, was largely in excess of the average, and serious floods prevailed at different periods of the month in nearly all the smaller rivers and streams tributary thereto.

Precipitation was also comparatively heavy over the upper Mississippi and Missouri valleys, the Rocky Mountain and Plateau districts; also over practically all of California, where the month, like December, 1906, was unusually wet, with showers of almost daily occurrence in the central and northern districts and generally abundant rains in the southern portion of the State.

Exceptionally heavy precipitation for the month occurred over western Colorado, northern New Mexico, and generally over Utah.

Over New England, the Atlantic coast districts, Florida, the Gulf States, eastern Tennessee, and western North Carolina the monthly precipitation was much below the average fall.

Along the Atlantic coast from Virginia to Florida and the entire Gulf coast, a marked deficiency in rainfall has prevailed since November, 1906, inclusive, the accumulated deficiency during that period amounting to as much as 10 inches at points on the immediate coast.

Over western North Carolina, eastern Tennessee, and northern Georgia the monthly amounts were the least recorded in any January during thirty-five years.

Precipitation was also deficient to a large degree over the western and northern portions of Washington.

## SNOWFALL.

The snowfall over all southern districts was comparatively light, and especially over the districts between the Mississippi River and the Rocky Mountains and south of Nebraska. Over the districts east of the Mississippi Valley snowfall did not extend south of the northern part of the Gulf States.

Snowfall was unusually heavy from the upper Lake region westward along the northern border to Washington, the amounts over North Dakota and eastern Montana being phenomenal both as to depth of fall and length of period during which the ground was covered.

Snow was generally heavy over the western mountain and Plateau districts, and a large amount has accumulated at the higher elevations, while over the lower levels the unfrozen ground generally absorbed the rain and melting snow, thus assuring an unusual supply of water during the coming season over most sections.

At the end of the month but little snow remained on the ground except over New England, New York, western Penn-

sylvania, the Lake region, upper Mississippi and Missouri valleys, and in the elevated portions of the western mountain districts.

From Lake Superior westward to northern Washington, the ground was covered to an unusual depth. Over the greater part of northern Minnesota, nearly the whole of North Dakota, and the northeastern counties of Montana, the snow covering at the close of the month was from two to more than four feet in depth.

#### HUMIDITY AND CLOUDINESS.

Humid conditions prevailed in all districts, except over the immediate coast of the South Atlantic and Gulf States and the western parts of Oregon and Washington. Over the entire Rocky Mountain and Plateau country the humidity was far in excess of the average, and cloudy weather predominated, especially over the central and southern districts of that region.

Cloudy weather was also prevalent from the Lake region to the northern part of the Gulf States, and from the Appalachian Mountains westward over the Ohio and central Mississippi valleys.

An excess of sunshine prevailed along the south Atlantic and Gulf coasts and over western Washington.

#### Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	12	23.8	-1.2		
Middle Atlantic	16	36.2	+3.4		
South Atlantic	10	53.0	+7.0		
Florida Peninsula*	8	65.2	+5.4		
East Gulf	11	57.4	+9.5		
West Gulf	10	56.8	+10.4		
Ohio Valley and Tennessee	13	41.3	+7.4		
Lower Lake	10	27.0	+1.6		
Upper Lake	12	18.1	0.0		
North Dakota*	5	-5.8	-11.4		
Upper Mississippi Valley	15	22.7	+2.4		
Missouri Valley	12	20.8	+0.5		
Northern Slope	9	11.6	-5.9		
Middle Slope	6	33.2	+4.2		
Southern Slope*	7	46.3	+8.1		
Southern Plateau*	12	40.7	+2.8		
Middle Plateau*	10	27.5	+2.4		
Northern Plateau*	13	20.4	-4.7		
North Pacific	8	35.1	-4.1		
Middle Pacific	4	45.7	-1.8		
South Pacific	4	50.0	-0.6		

\* Regular Weather Bureau and selected cooperative stations.

#### In Canada.—Director R. F. Stupart says:

The temperature was below the average in all portions of the Dominion, except in the Peninsula of Ontario, where it was either average or 1° above. The negative departures in British Columbia, Alberta, and Saskatchewan, ranging as they did from 10° to 22°, were phenomenal, and in these provinces it was the coldest January of which the meteorological service has any record. In Manitoba the negative departures were also pronounced, but the mean temperature was not as low in that province as recorded in some previous months of January. Over the greater portion of Ontario and through Quebec and the Maritime Provinces the negative departures ranged from 1° to 3°.

#### Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	0	Missouri Valley	81	+6
Middle Atlantic	77	+1	Northern Slope	80	+9
South Atlantic	81	+4	Middle Slope	76	+9
Florida Peninsula	79	-2	Southern Slope	72	+11
East Gulf	80	+4	Southern Plateau	70	+17
West Gulf	80	+4	Middle Plateau	79	+9
Ohio Valley and Tennessee	79	+2	Northern Plateau	82	+3
Lower Lake	85	+4	North Pacific	78	-4
Upper Lake	84	+1	Middle Pacific	84	+2
North Dakota	85	+6	South Pacific	79	+7
Upper Mississippi Valley	86	+8			

#### Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Bismarck, N. Dak.	19	50	nw.	New York, N. Y.	9	59	w.
Block Island, R. I.	9	56	nw.	Do.	20	58	w.
Do.	21	52	w.	Norfolk, Va.	20	52	sw.
Buffalo, N. Y.	10	60	sw.	North Head, Wash.	2	72	se.
Do.	20	84	sw.	Do.	3	84	se.
Do.	21	50	w.	Do.	18	52	nw.
Burlington, Vt.	3	50	s.	Do.	20	72	se.
Do.	19	50	se.	Do.	31	51	s.
Do.	20	60	se.	Oklahoma, Okla.	19	58	s.
Canton, N. Y.	9	50	w.	Peoria, Ill.	20	51	w.
Do.	20	78	sw.	Pittsburg, Pa.	20	62	w.
Cape Henry, Va.	26	52	n.	Point Reyes Light, Cal.	1	60	nw.
Chicago, Ill.	19	52	w.	Do.	4	64	s.
Do.	20	60	w.	Do.	5	50	nw.
Cleveland, Ohio	19	58	s.	Do.	6	52	nw.
Do.	20	66	sw.	Do.	10	58	s.
Do.	21	54	w.	Do.	12	52	nw.
Columbus, Ohio	20	66	nw.	Do.	16	66	sw.
Detroit, Mich.	20	54	sw.	Port Huron, Mich.	19	50	sw.
Fort Smith, Ark.	19	66	w.	Do.	20	58	w.
Grand Rapids, Mich.	19	50	w.	Rochester, N. Y.	20	54	w.
Huron, S. Dak.	2	50	s.	St. Louis, Mo.	19	52	w.
Indianapolis, Ind.	19	52	sw.	Sioux City, Iowa	19	66	nw.
Do.	20	52	sw.	Southwest Farallon, Cal.	4	54	s.
Knoxville, Tenn.	19	58	sw.	Do.	16	58	s.
Lexington, Ky.	19	54	sw.	Do.	20	57	sw.
Do.	20	52	w.	Springfield, Mo.	19	53	sw.
Memphis, Tenn.	19	60	w.	Syracuse, N. Y.	20	57	sw.
Modena, Utah	15	50	sw.	Tatoosh Island, Wash.	3	62	sw.
Mount Tamalpais, Cal.	4	56	se.	Do.	7	59	e.
Do.	12	51	nw.	Do.	8	61	e.
Do.	31	52	sw.	Do.	13	56	ne.
Mount Weather, Va.	4	72	nw.	Do.	14	65	ne.
Do.	9	58	nw.	Do.	20	61	s.
Do.	20	60	nw.	Toledo, Ohio	19	57	s.
Do.	21	50	nw.	Do.	20	70	sw.
Do.	22	58	nw.	Valentine, Nebr.	19	54	nw.
Do.	23	54	nw.				

#### Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	7.0	+1.2	Missouri Valley	7.2	+2.1
Middle Atlantic	6.6	+1.0	Northern Slope	5.9	+1.3
South Atlantic	4.9	-1.3	Middle Slope	6.1	+2.3
Florida Peninsula	3.4	-1.3	Southern Slope	5.1	+1.0
East Gulf	5.4	-0.2	Southern Plateau	4.4	+1.5
West Gulf	6.4	+1.0	Middle Plateau	6.3	+1.9
Ohio Valley and Tennessee	7.5	+1.1	Northern Plateau	7.4	+0.1
Lower Lake	8.2	+0.7	North Pacific	6.5	-0.6
Upper Lake	7.7	+0.9	Middle Pacific	7.3	+2.1
North Dakota	6.0	+1.3	South Pacific	6.4	+2.3
Upper Mississippi Valley	7.5	+2.2			

#### Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percent- age of normal.	Current month.	Accumulated since Jan. 1.
		<i>Inches.</i>		<i>Inches.</i>	<i>Inches.</i>
New England.....	12	2.97	77	—0.9	.....
Middle Atlantic.....	16	2.07	60	—1.4	.....
South Atlantic.....	10	0.76	18	—3.4	.....
Florida Peninsula *.....	8	0.50	17	—2.5	.....
East Gulf.....	11	2.37	48	—2.6	.....
West Gulf.....	10	2.11	64	—1.2	.....
Ohio Valley and Tennessee.....	13	6.12	145	+1.9	.....
Lower Lake.....	10	4.18	156	+1.5	.....
Upper Lake.....	12	2.56	124	+0.5	.....
North Dakota *.....	9	1.20	240	+0.7	.....
Upper Mississippi Valley.....	15	3.46	197	+1.7	.....
Missouri Valley.....	12	2.21	219	+1.2	.....
Northern Slope.....	9	0.84	131	+0.2	.....
Middle Slope.....	6	1.02	142	+0.3	.....
Southern Slope *.....	7	1.35	142	+0.4	.....
Southern Plateau *.....	12	2.03	197	+1.0	.....
Middle Plateau *.....	10	1.36	128	+0.3	.....
Northern Plateau *.....	12	2.12	109	+0.1	.....
North Pacific.....	7	5.68	76	—1.8	.....
Middle Pacific.....	8	6.21	115	+0.8	.....
South Pacific.....	4	5.60	200	+2.8	.....

\* Regular Weather Bureau and selected cooperative stations.

#### In Canada.—Director Stupart says:

The precipitation was generally below the average in British Columbia, the negative departures varying from half an inch to an inch and a

half. In the western provinces the precipitation was all snow, which in some localities was a few inches more than the usual quantity and in others a few inches less. In Ontario the precipitation was above the average amount in the Lake Superior region and in the Peninsula of Ontario, and much below again in the eastern portion of the province, Kingston recording a negative departure of 1.5 inches, Ottawa 1.1 inches, and Rockliffe 1.1 inches. In Quebec it was slightly in excess of the average in the eastern portion and deficient elsewhere. In the Maritime Provinces it was everywhere below the average, except in one or two isolated localities, where it was slightly above; the chief positive departures were St. John, 1.6 inches, and Fredericton, 1.3 inches.

At the close of the month the whole Dominion was snow covered, the depth on the ground differing materially with the district. In British

Columbia the amount in many localities was considerable; even coast stations similar to New Westminster report continuous sleighing throughout the month, which is most unusual. In the western Provinces, owing to the long-continued cold weather, the snow which covered the ground at the close of 1906, with the addition of that which fell in January, now amounts to a depth of from 10 to over 30 inches, a marked contrast to the conditions prevailing in January last year, when in some localities the ground was bare of snow and in others it was but lightly covered. In Ontario, in the Lake Superior district, and in far northern localities, the snow on the ground varies from 18 to 24 inches, elsewhere from 3 to 10 inches. In Quebec it varies from 18 to 26 inches in the western portion, to 46 and 48 inches in the eastern portion. In the Maritime Provinces it is from 4 to 11 inches, and very locally 18 inches.

## DESCRIPTION OF TABLES AND CHARTS.

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Table I gives the data ordinarily needed for climatological studies for about 152 Weather Bureau stations making simultaneous observations at 8 a. m. and 8 p. m., seventy-fifth meridian time daily, and for about 36 others making only one observation. The altitudes of the instruments above ground are also given.

Table II gives, for about 2800 stations occupied by cooperative observers, the absolute maximum and minimum temperatures of the month, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . .).

Table III gives, for all regular stations, the four component directions and the direction resultant of the wind based on the twice-daily observations, taken at 8 a. m. and 8 p. m., respectively, or upon a single observation at a limited number of the less important stations, and without considering the velocity.

Stations taking but a single observation daily are indicated in the table by appropriate references.

The total wind movement for the whole month, for each station, is given in Table I.

Table IV gives a record of precipitation the intensity of which at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes	5	10	15	20	25	30	35	40	45	50	60
Rates per hour (inches)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.87	0.84	0.80

In cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest precipitation of any single storm has been given, also the greatest hourly fall during that storm.

Table V gives, for about 30 stations of the Canadian Meteorological Service, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VI gives the heights of rivers referred to zeros of gages. These zeros are arbitrarily fixed, but, as a rule, are set at the plane of lowest water, if possible. The river gages are read once daily (8 a. m., seventy-fifth meridian time), and in times of emergency more frequently. The table shows the highest and lowest of all readings taken, the means of the regular daily readings, and the absolute monthly ranges.

Chart I.—Hydrographs for seven principal rivers of the United States.

Chart II, tracks of centers of high areas, and Chart III, tracks of centers of low areas. The roman numerals show number and chronological order of the centers. The figures within the circles show the days of the month; the letters *a* and *p* indi-

cate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart II) the highest barometric reading and (Chart III) the lowest reading reported at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart IV.—Total precipitation. The scale of shades showing the depth is given on the chart. Where the monthly amounts are too small to justify shading, and over sections of the country where the stations are too widely separated, or the topography is too diversified to warrant reasonable accuracy in shading, the actual depths are given for a limited number of representative stations. Amounts less than 0.005 inch are indicated by the letter "T," and no precipitation by 0.

Chart V.—Percentage of clear sky between sunrise and sunset. The average cloudiness at each Weather Bureau station is determined by numerous personal observations between sunrise and sunset. The difference between the observed cloudiness and 100 is assumed to represent the percentage of clear sky, and the values thus obtained are the basis of this chart, which does not relate to the nighttime.

Chart VI.—Isobars and isotherms at sea level and surface wind resultants. The pressures have been reduced to sea level and standard gravity by the method described by Prof. Frank H. Bigelow on pages 13-16 of the REVIEW for January, 1902. The pressures have also been reduced to the mean of the twenty-four hours by the application of a suitable correction to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively; at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900-1901, pp. 140-164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of the Annual Report of the Chief of the Weather Bureau for 1900-1901, Volume II. The correction  $t_0 - t$ , or temperature on the sea-level plane minus the station temperature, as given by Table 48 of the above report, is added to the observed surface temperature to obtain the adopted sea-level temperature.

The surface wind direction resultants are computed from observations at 8 a. m. and 8 p. m. daily, or from observations at but one of those hours at stations taking a single observation only. The duration resultants are shown by figures attached to the arrows.

Chart VII.—Total snowfall. This is based on the reports from regular and cooperative observers, and shows the depth in inches and tenths of the snowfall during the month. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart VIII.—Depth of snow on ground at the end of month, expressed in inches and tenths.